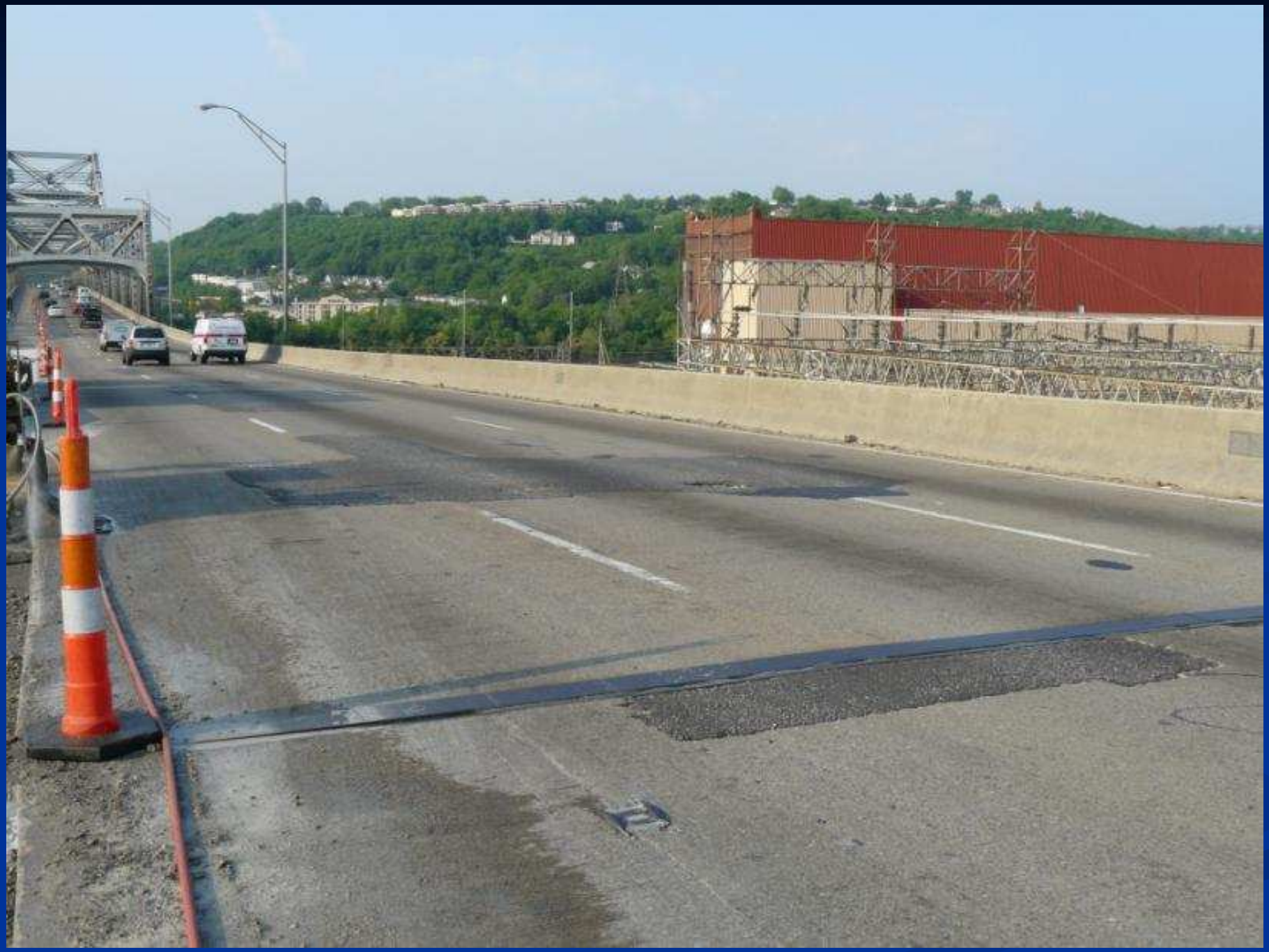
Hydro-Technologies, Inc.
Modified Concrete Suppliers, LLC

Maintaining and Preserving Bridge Decks using Fast Track Hydrodemolition Surface Preparation and Latex Modified Concrete Overlays

Part 1 – Hydrodemolition Surface Preparation

2010 Southeast Bridge Preservation Partnership Meeting

Orlando, Florida
April 28, 2010



Economic Stimulus Funds

- 2009 - Congress passed the stimulus bill
- Over 30 billion dollars went to transportation
- Bridge projects were placed on the federal fast track
- Bridge deck preservation is a priority with many states – "Fix it First" before it is too late is the attitude being adopted by many DOT's. Available funds must stretch as far as possible.
- 2009 & 2010 are record years for Hydrodemolition and LMC Overlay bridge deck repairs.

Bridge Deck Preservation

- It is very cost effective to attain a minimum of 50 years of service life from a bridge deck.

- By placing LMC Overlays on Hydrodemolition prepared bridge deck surfaces before decks becomes structurally deficient, 75 years to 100 years of service life or more can be achieved.

- The use of **Fast Track Hydrodemolition and LMC Overlays** will provide an owner with an economical, long lasting and very fast bridge overlay construction method.

Bridge Deck Preservation Strategies

- ***75 Year Bridge Decks***
  - Year 1 – Construct New Bridge Deck
  - Year 25 – Place LMC O/L #1 – Hydrodemolition
  - Year 50 – Place LMC O/L #2 – Hydrodemolition
  - Year 75 – Replace Bridge Deck

Bridge Deck Preservation Strategies

- ***100 Year Bridge Decks***
  - Year 1 – Construct New Bridge Deck with LMC O/L
  - Year 25 – Place LMC O/L #1 – Hydrodemolition
  - Year 50 – Place LMC O/L #2 – Hydrodemolition
  - Year 75 – Place LMC O/L #3 – Hydrodemolition
  - Year 100 – Replace Bridge Deck

Fast Track Hydrodemolition Bridge Deck Surface Preparation

Hydrodemolition Definition

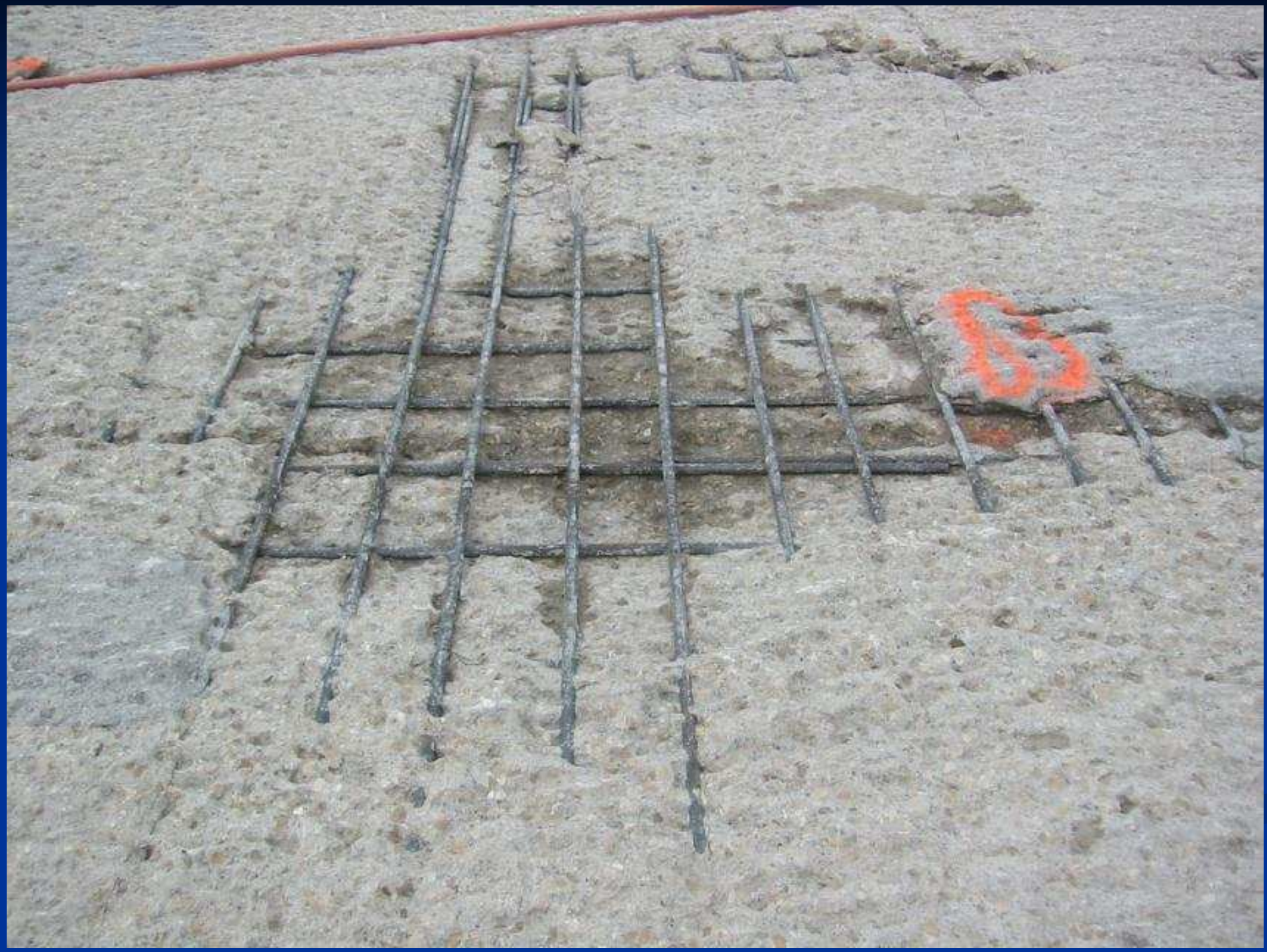
- Hydrodemolition is a mechanical process by which deteriorated concrete is removed utilizing a high pressure water jet.
- By rapid erosion with the high pressure water, the cement matrix and fine aggregates between the course aggregate is essentially washed away.
- By properly calibrating the hydrodemolition robot movements, concrete of uniform strength can be removed to a specified depth.

Hydrodemolition Applications

- Surface preparation of the total area of bridge decks prior to placement of overlays.
- Surface preparation for patches in bridge decks.
- Selective portions of structures removed – bridges, shipping piers, factory's, parking garages, nuclear power plants.

Fast Track Hydrodemolition Surface

- Fastest way to prepare a bridge deck surface for a concrete overlay.
- Highly rough and bondable surface.
- Reduces Chloride Ion concentrations in the deck.
- With proper milling, only sound concrete remains.
- Has 300% to 400% more bondable area than surface milling alone.
- Stone is not cut – aggregates are protruding.
- Exposes and cleans reinforcing steel. Will not damage or dislodge reinforcing steel. No vibrations.
- Highest quality LMC Overlays are achieved.



Hydrodemolition Equipment

- Consists of Pump & Power Unit, Hydrodemolition Robot and Vacuum Truck.
- Can be readily mobilized to any project.
- Set up time is quick and relatively easy.

Hydrodemolition Pump Unit

- Receives water intake from either tankers, hydrant or directly from stream or lake.
- Filters and pressurizes water.
- Supplies water at 15,000 psi and 55 ga/min to the Hydrodemolition Robot.


100% American Owned Corporation
team
Hydro Tech
812 28HYDRO
Quality & Service Creates It's Own Demand


Ryder


team
Hydro Tech

Hydrodemolition Robot

- Computerized and Self-Propelled.
- Water from the power unit exits through a ¼" jet nozzle.
- Controls allow operator to control the removal depth of the concrete by adjusting the step of the machine and the glide of the water jet.

Hydrodemolition Vacall Unit

- Cleans and washes bridge deck surface.
- Removes all hydrodemolition debris and slurry.


30055


Hydro Tech
3006

The Fast Track Hydrodemolition/LMC Bridge Overlay Method

- Fastest and most cost effective way to overlay a bridge deck.
- A minimum of 20 years of service life will be attained by the overlay if surface is properly prepared and overlay is properly placed.
- Consists of 4 steps

The Fast Track Hydrodemolition/LMC Bridge Overlay Method

- Step 1 – Mechanical Milling of the Existing Bridge Deck Surface to a Specified Depth or to the Top Matt of Reinforcing Steel.

- Mill for depth – Cost Effective
- Mill to top mat of reinforcing steel.


MAMCO
Jeffersonville, In.
W 1200 F
2115

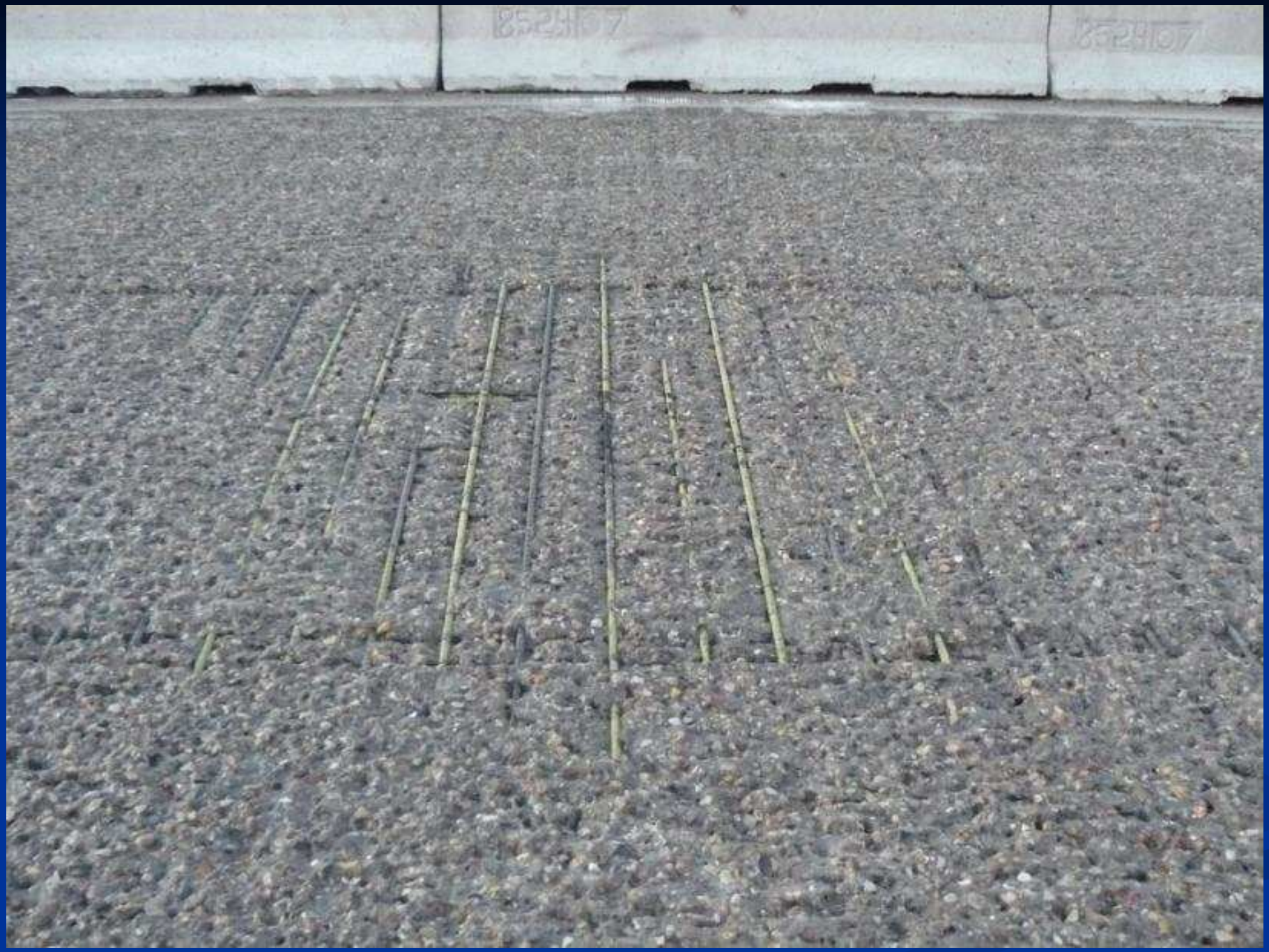
The Fast Track Hydrodemolition/LMC Bridge Overlay Method

- Step 2 – Perform Total Surface Hydrodemolition.
- Hydro to get the bad concrete out below the milling line and to provide a highly bondable surface.
- Do not hydro for depth – not cost effective.

The Fast Track Hydrodemolition/LMC Bridge Overlay Method

- Step 3 – Final Cleaning of the Bridge Deck Surface and Minor Hand Chipping in Areas Inaccessible to The Hydrodemolition Equipment.
- Clean closely behind the hydro robot.
- Do not leave loose debris or slurry on the bridge deck surface.

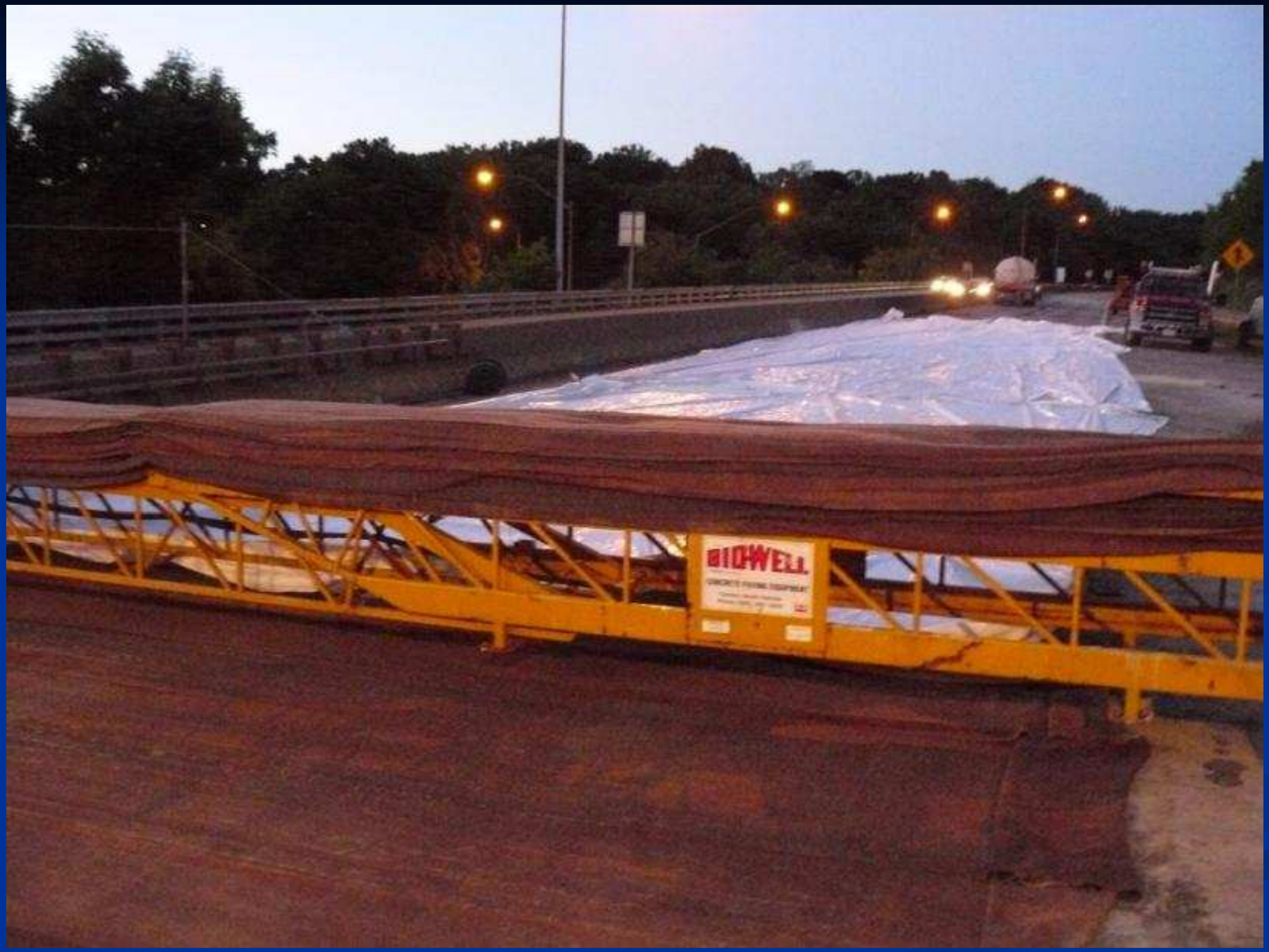

STAY BACK
200
FEET
JOHN DEERE

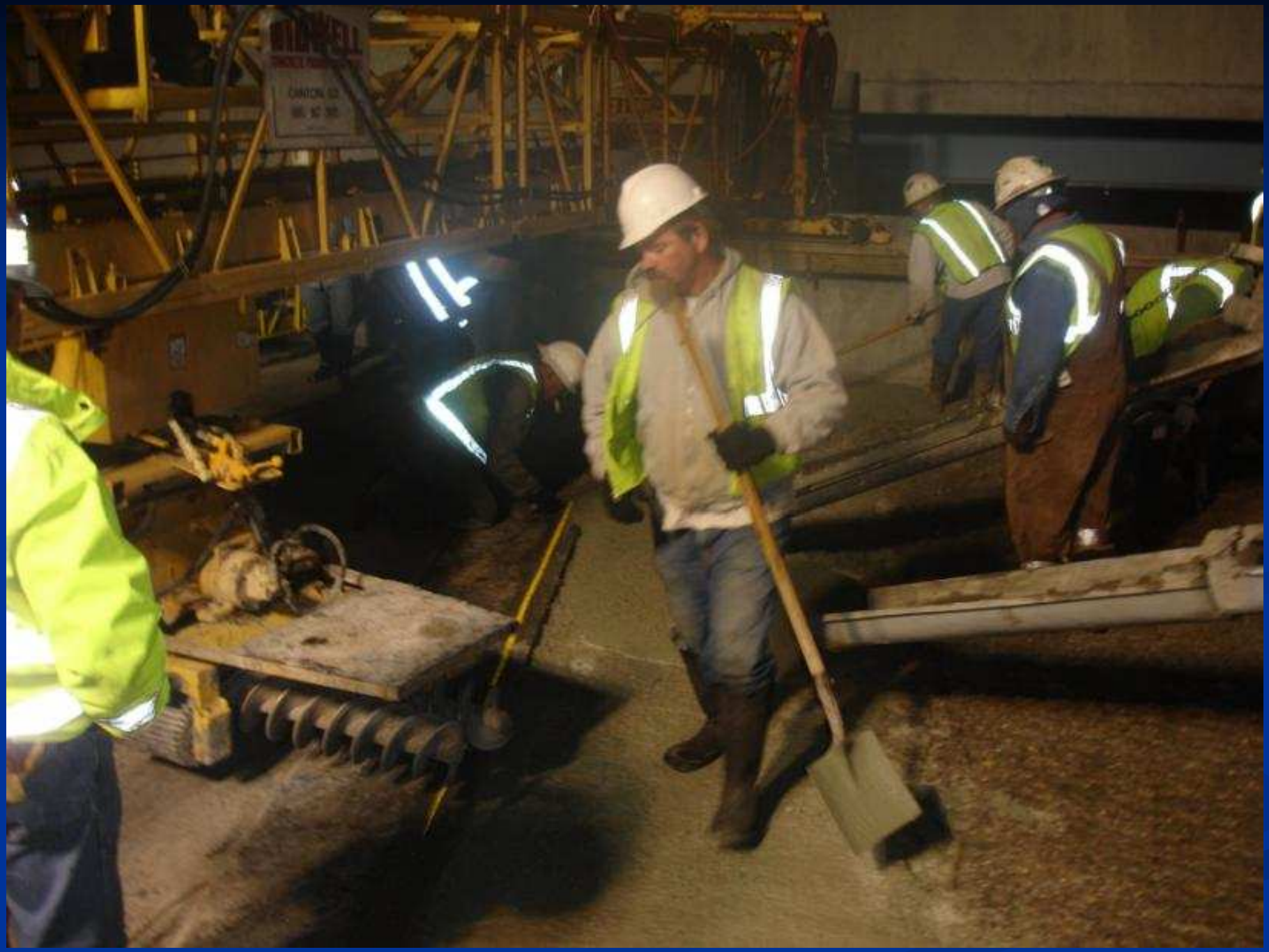


The Fast Track Hydrodemolition/LMC Bridge Overlay Method

- Step 4 – Placement of Latex Modified Concrete Overlay.
- Place during optimum weather conditions.
- Surface must be extremely clean and in a damp condition.


CAS
22-80
NICK CORP


BIDWELL

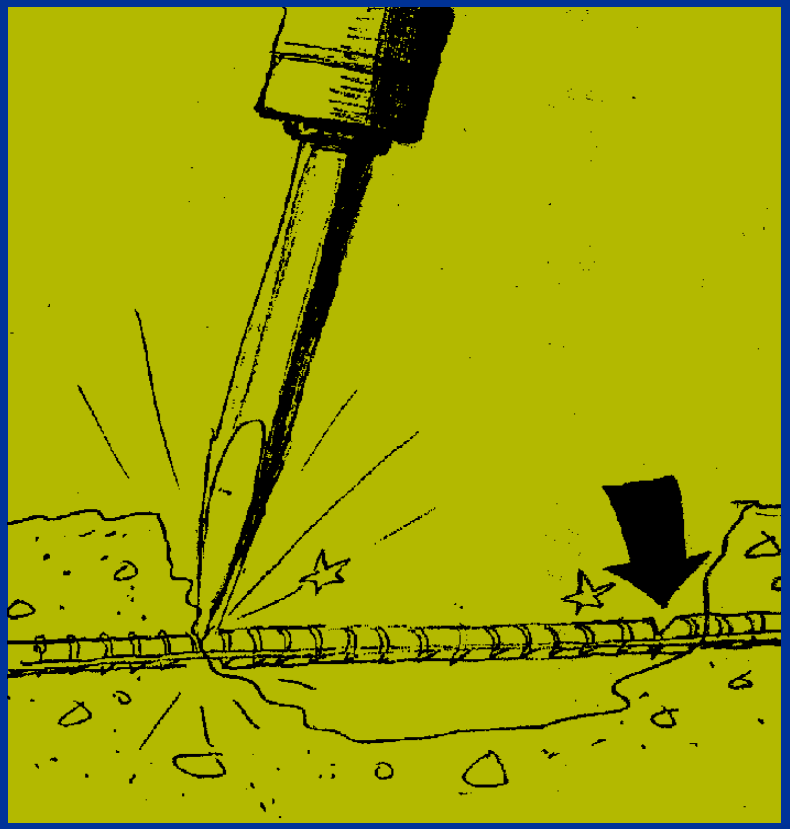


Fast Track Hydrodemolition Advantages

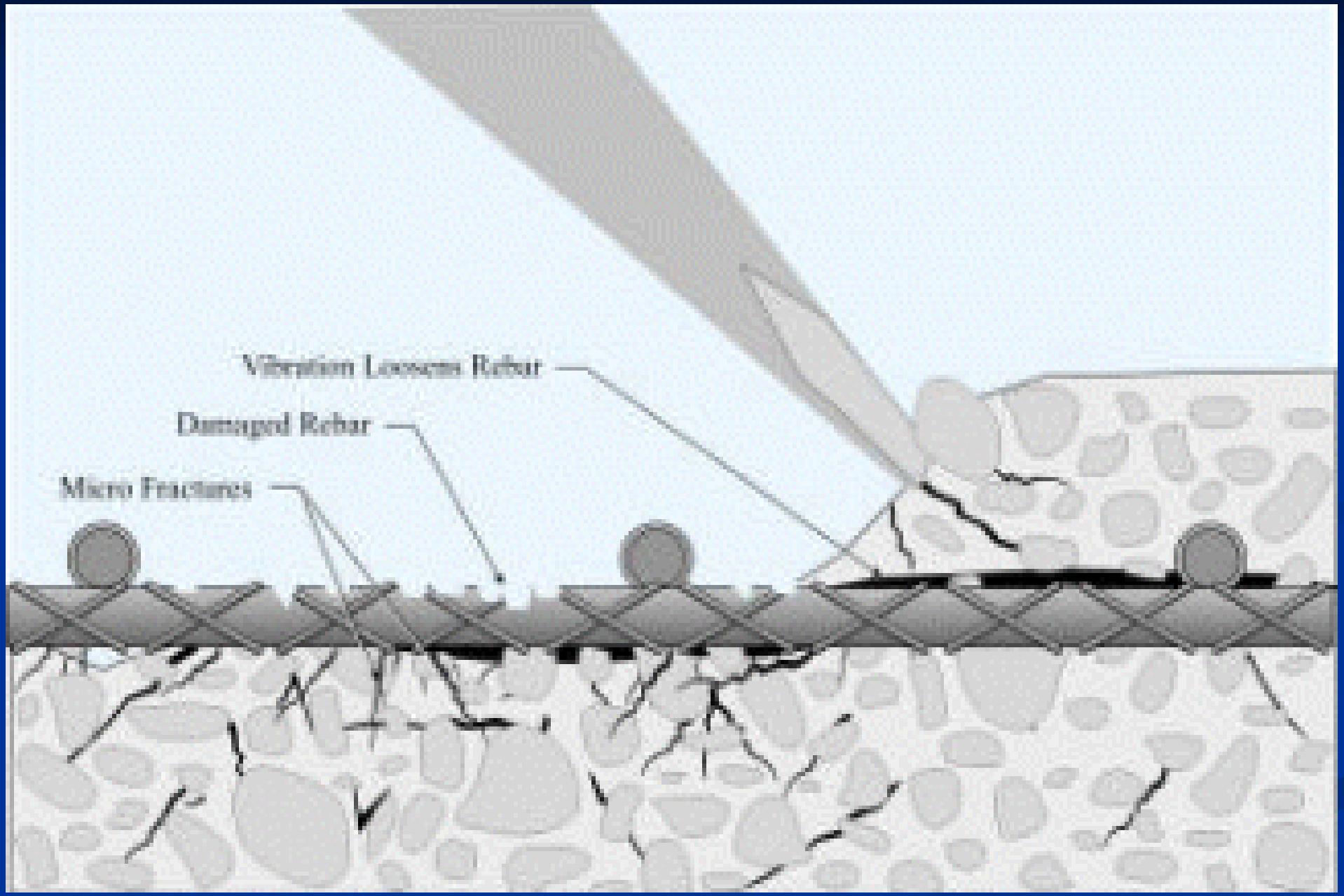
- ***Speed*** – A fast, productive and economical way to prepare a bridge deck for a Latex Modified Concrete Overlay.
- ***Quality*** - Selectively removes delaminated concrete and avoids the unnecessary removal of sound concrete.
- Removes chloride contaminated concrete.
- Will not damage existing reinforcing steel. Actually cleans and descales the steel. No mechanical damage.
- Surface has 300 % to 400 % more bondable area than a mechanical milled surface.
- ***Cost Savings*** - Long term service life and maintenance cost savings. Immediate traffic control and road user cost savings.
- ***Construction*** - Replaces jackhammers. Lower Noise Levels. No fugitive dust. No micro-cracking of deck concrete.


Medical Cntr Dr
King Ave
EXIT 1/2 MILE

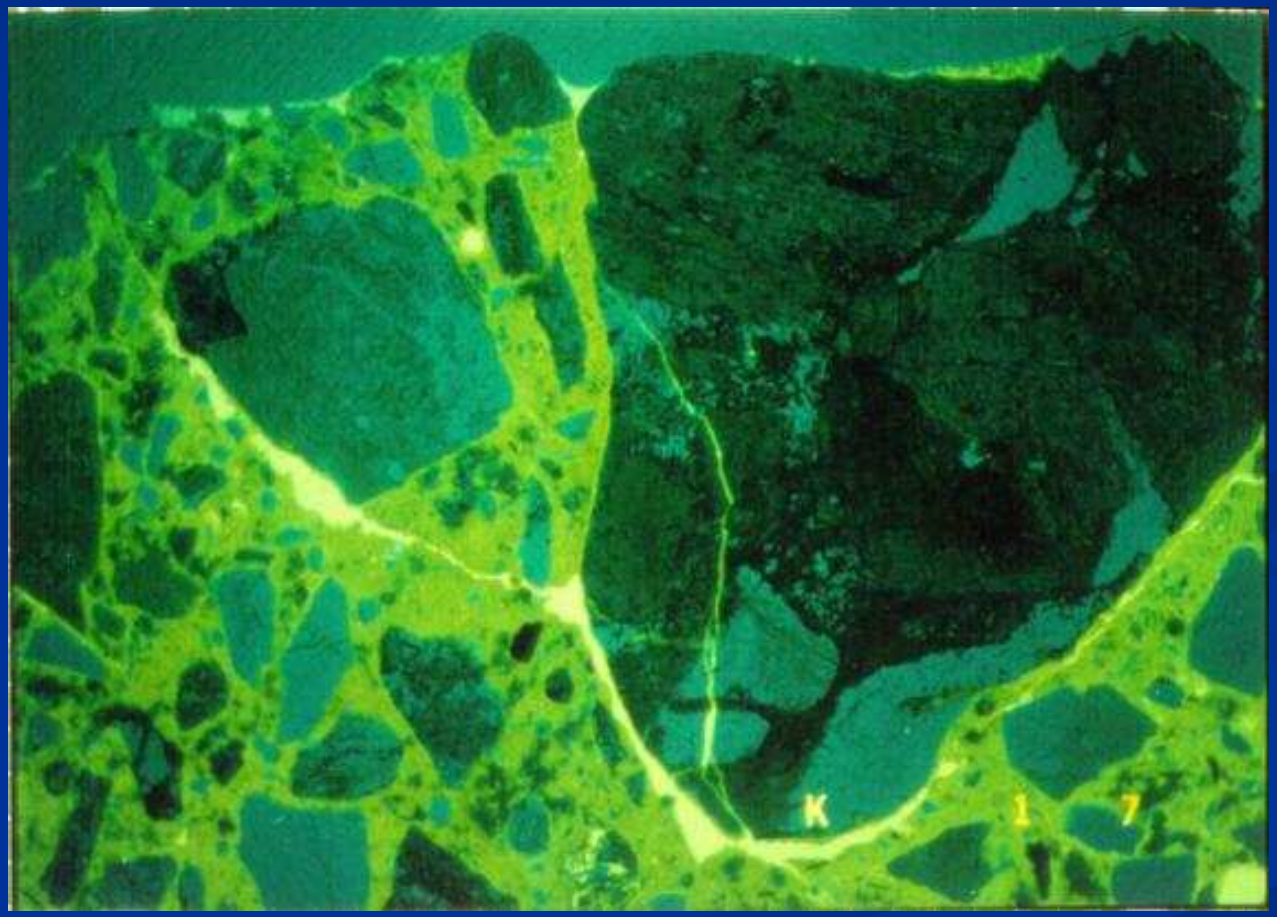
Jack hammer the method of yesterday



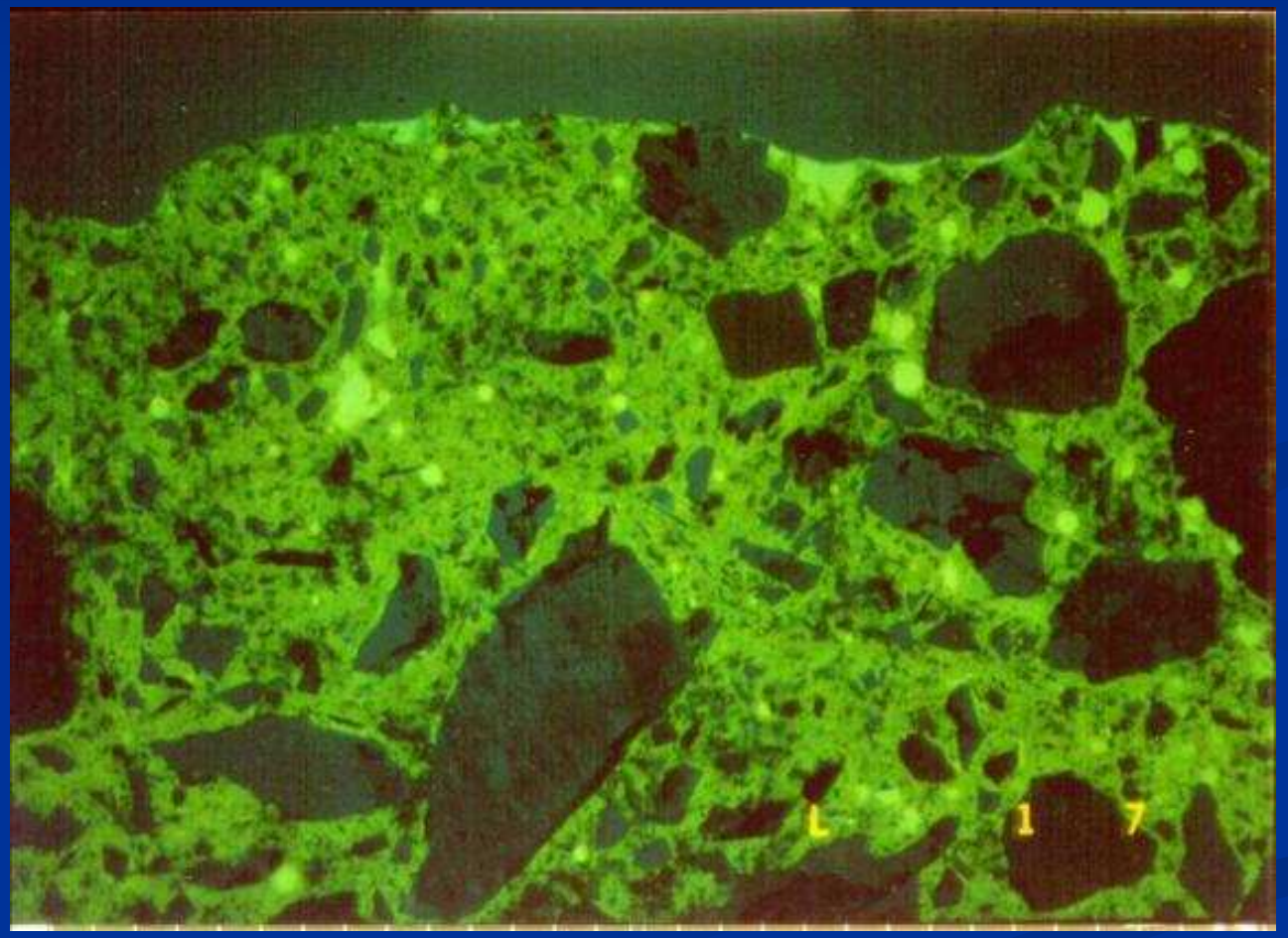
- Damage to rebars.
- Vibrations in the rebars cause long distance damage to the bond in the structure
- Causes new micro cracks.
- No selective removal.
- Labour intensive.
- Hand and arm vibrations
- Slow and noisy.


Vibration Loosens Rebar
Damaged Rebar
Micro Fractures

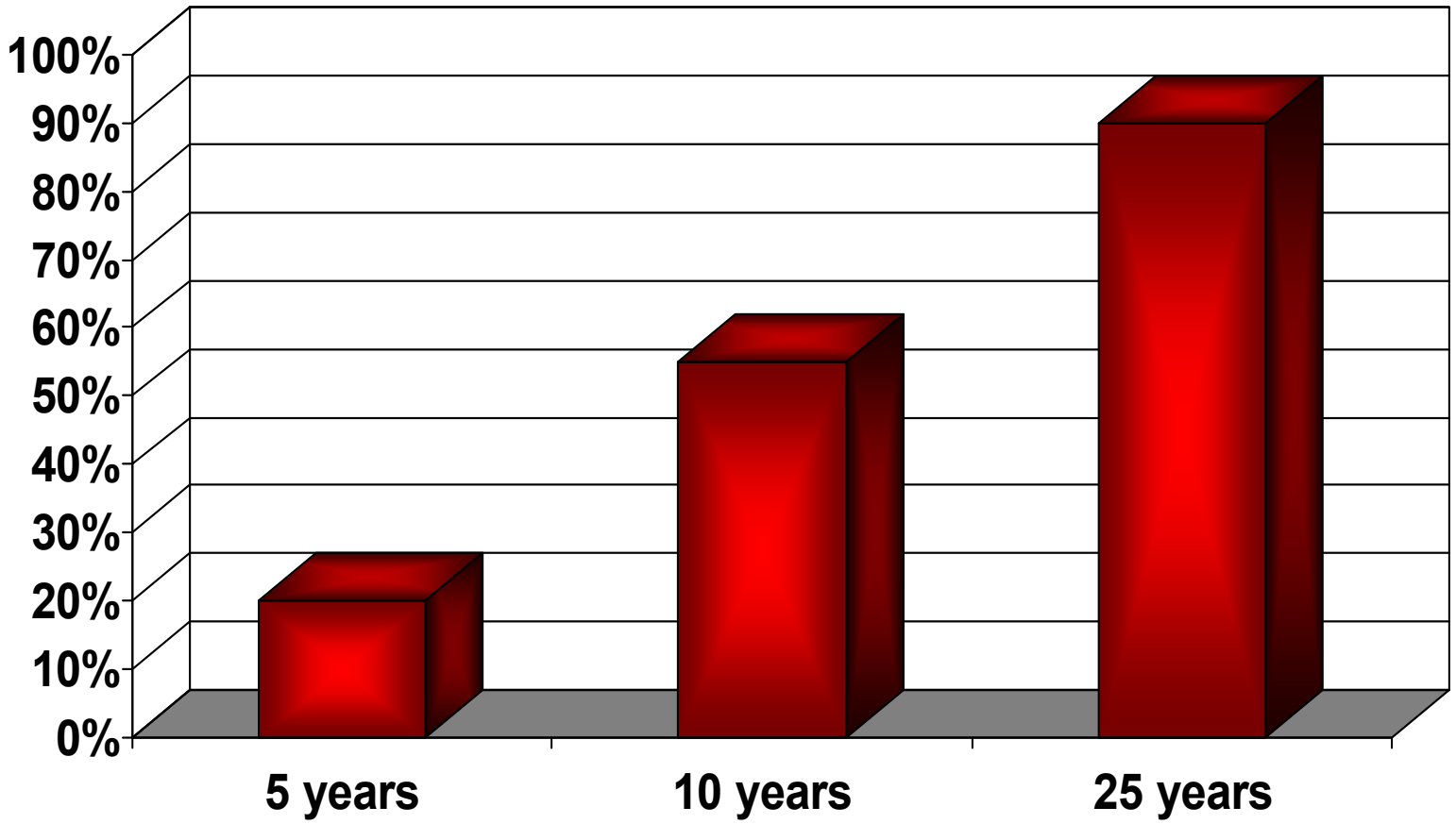
Micro cracks and no bond is shown on a thin section after use of a jackhammer.



Thin section sample after using Hydrodemolition showing no micro cracks



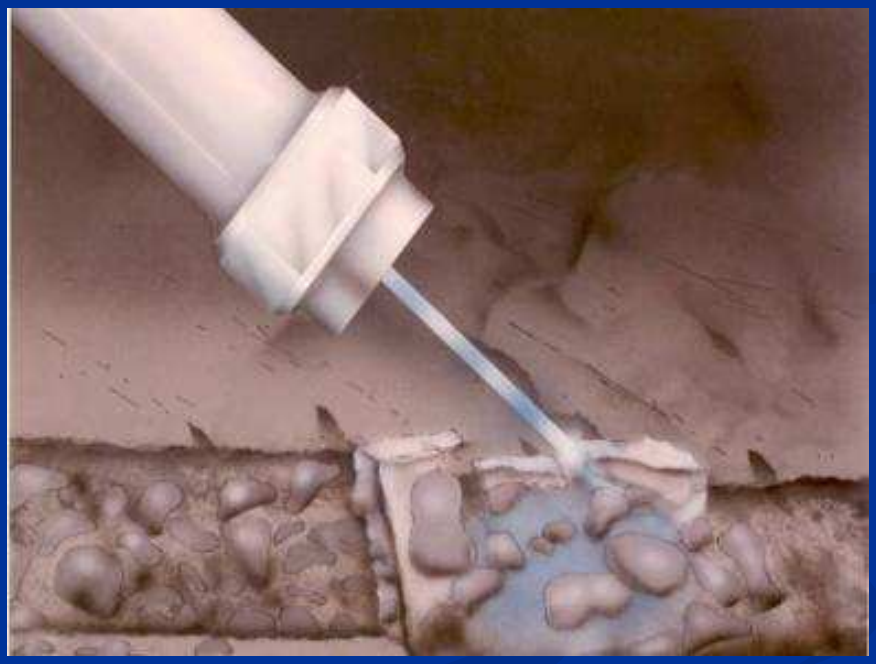
Failure rate after repair on concrete structures with percussion methods



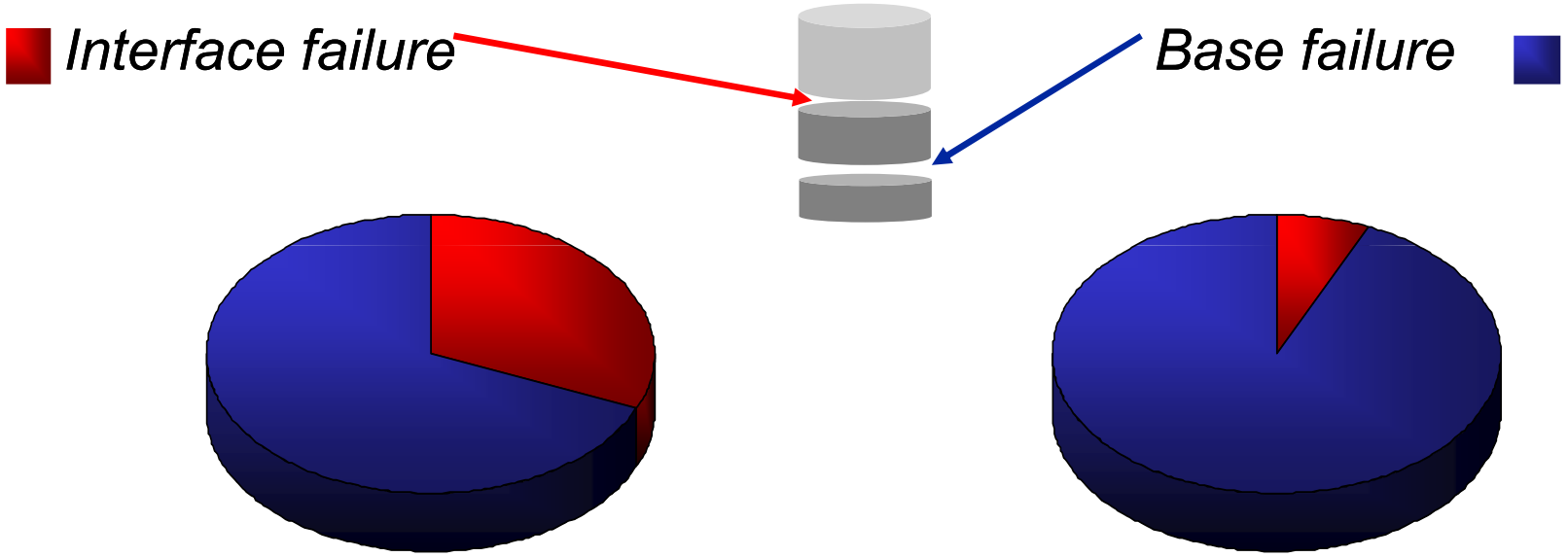
Source: *Concrete Repairs – Performance in service and current practice, GP Tilly & J Jacobs,* CONREPNET 2007

Hydrodemolition method

Causes no micro cracks, creates good bonding, a rough surface to bond to and selective removal.



Interface failure obtained through pull-off tests – bonding at interface.

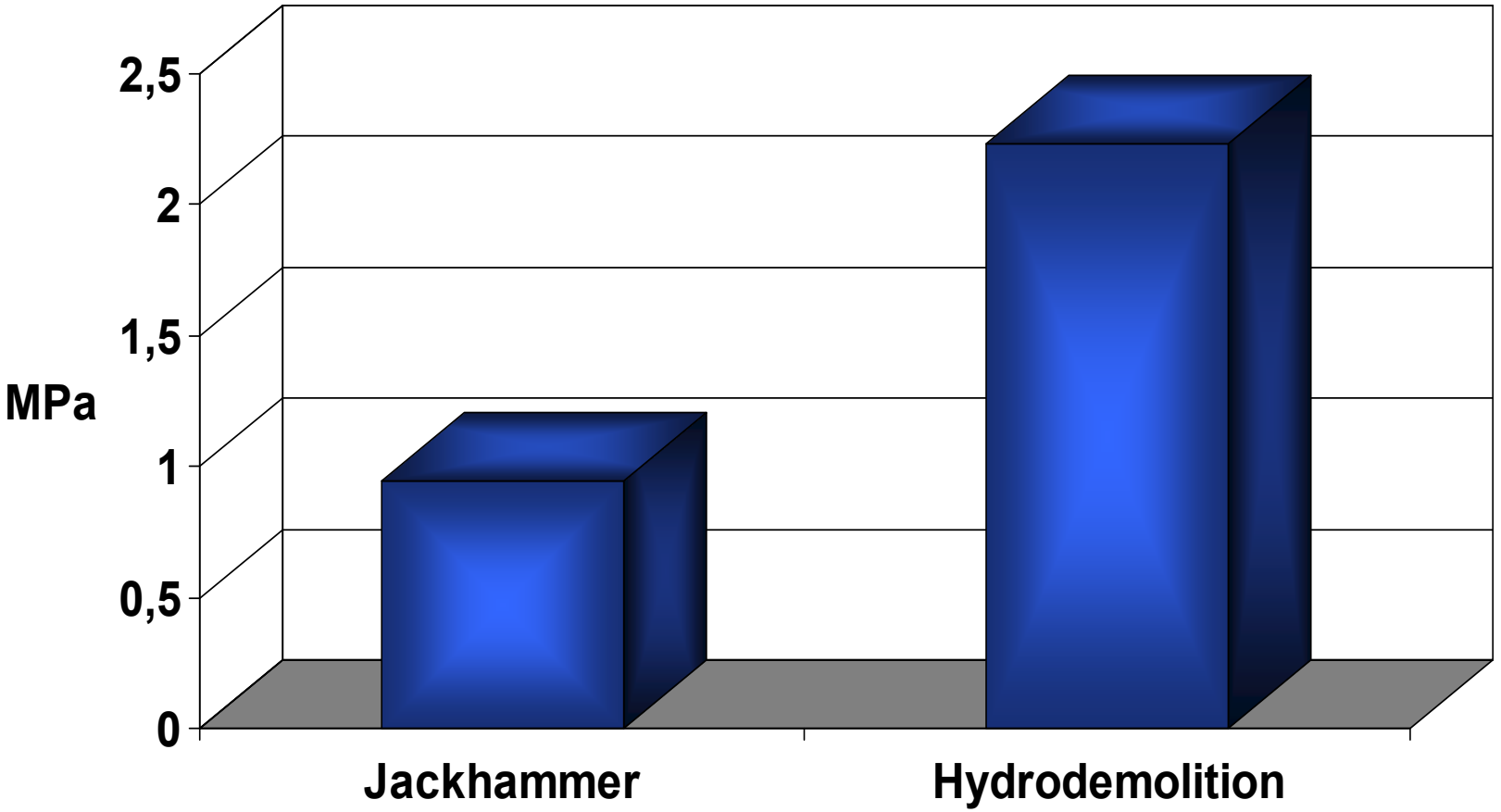


Jack-hammer 31% 5(16)

Hydrodemoltion7% 1(15)

Source: Concrete International, Sep 1990, Prof. Johan Silfwerbrand

Bond strength comparison of interface failures using pull-off tests.



Source: Concrete International, Sep 1990, Prof. Johan Silfwerbrand

Bonding - key issue
Lower life cycle cost

- A good bond creates improved load capacity and reduce deformation
- A good bond prevents water and chlorides to spread in the interface
- A good bond will ensure that the structure will last longer
- A good bond will consequently require less maintenance and repair
- Minimizes risk for Warranty claims

Hydrodemolition Surface Preparation Video

Hydrodemolition Surface Preparation Video

Calibration of Hydro Equipment

- ***Calibration*** – First on a (7'x7') area of sound concrete – demonstrate the desired result of the specification. Second on a (7'x7') area of unsound concrete – demonstrate the desired result of the specification which is providing highly rough and bondable surface and removing all unsound concrete during the initial pass.
- ***Machine Settings*** – Verify the following.
- Water pressure gage.
- Minimum water usage at 55 gal per minute
- Machine Staging Control (step)
- Nozzle size and type
- Nozzle speed (travel)
- ***Other*** – Stop the operation if it is determined that sound concrete is being removed or unsatisfactory results are being obtained. Perform appropriate recalibration or changes in equipment.

Hydro-Technologies, Inc.
Modified Concrete Suppliers, LLC

Maintaining and Preserving Bridge Decks using Fast Track Hydrodemolition Surface Preparation and Latex Modified Concrete Overlays

Part 2 – Latex Modified Concrete Overlays

2010 Southeast Bridge Preservation Partnership Meeting

Orlando, Florida
April 28, 2010

Latex Concrete Mix Design

- Fine Aggregate (Sand) - 1575 - 1855 lbs/cy
- Course Aggregate (# 8's) - 1106 - 1386 lbs/cy
- Cement (7 bags) - 658 lbs/cy
- Latex Emulsion - 24.5 gal/cy
- Water - 17.5 gal/cy
- Maximum Air - 7 %
- Slump - 4 to 6 in

** Cement = Type 1, Type 3 or Rapid Set

Latex Emulsion

- Suspension of tiny (.2 micron diam.) styrene-butadiene polymer particles in water, typically about 50% polymer solids.
- Styrene-butadiene polymers are known for their hydrophobicity or excellent water resistance.
- Polymer particles coalesce or fuse together when in intimate contact to form a highly waterproof polymer film.
- Essentially waterproofs concrete.

Latex Modified Concrete Characteristics

- LMC was specifically designed (1960's) for use as a thin bonded concrete bridge deck material. It's quality has withstood the test of time.
- A LMC Overlay is a structural bridge deck repair that will extend the service life of a bridge deck for over 25 years when placed on a hydrodemolition prepared concrete surface.
- LMC is very adhesive and develops great bond strengths to the existing deck.
- LMC shields the underlying deck because it is very impervious.
- LMC has greater flexural strength than conventional concrete.
- LMC is very wear resistant and improves the skid resistance on bridge decks
- LMC has a very low water/cement ratio. This characteristic prevents shrinkage cracking from occurring in the overlay.

Latex Modified Concrete Types

- Regular Mix - 4 day cure – 2 wet / 2 dry
- Type III Mix - 2 day cure – 1 wet / 1 dry
- Rapid Set Mix - 3 hrs wet = 2500 psi

Latex Modified Costs

- Regular Mix - $500.00 to $570.00 / cy
- Type III Mix - $530.00 to $600.00 / cy
- Rapid Set Mix - $750.00 to $900.00 / cy

* Cost vary based on pour size and mobilizations.

Latex Concrete Mobile Mixers

- Self-contained, mobile, continuous mixers.
- Self-propelled and have the capability to carry sufficient unmixed dry bulk cement, fine aggregate, course aggregate, latex emulsion and water in separate compartments to produce 10 cy of concrete on site.
- Provide controls for the flow of water and latex emulsion into the mixing chamber. Volumetric.
- Can be calibrated to automatically proportion and blend all components on a continuous or intermittent basis as required by the finishing operation, and can discharge mixed material through a conventional chute directly in front of the of the finishing machine.


TM 12


MODIFIED
CONCRETE
SUPPLIERS LLC
TM 27

Latex Modified Concrete Placement

- Surface must be properly prepared, clean and in a wet condition so no further surface evaporation occurs.
- Weather must be optimum.
- Must use proper self propelled finishing machine.
- Place overlay material monolithically with patches.
- Use hand held vibrators in areas where finish machine is not effective – edges, joints, all patches, curbs, etc.
- Cure overlay properly.
- Follow all individual state or owner specifications.

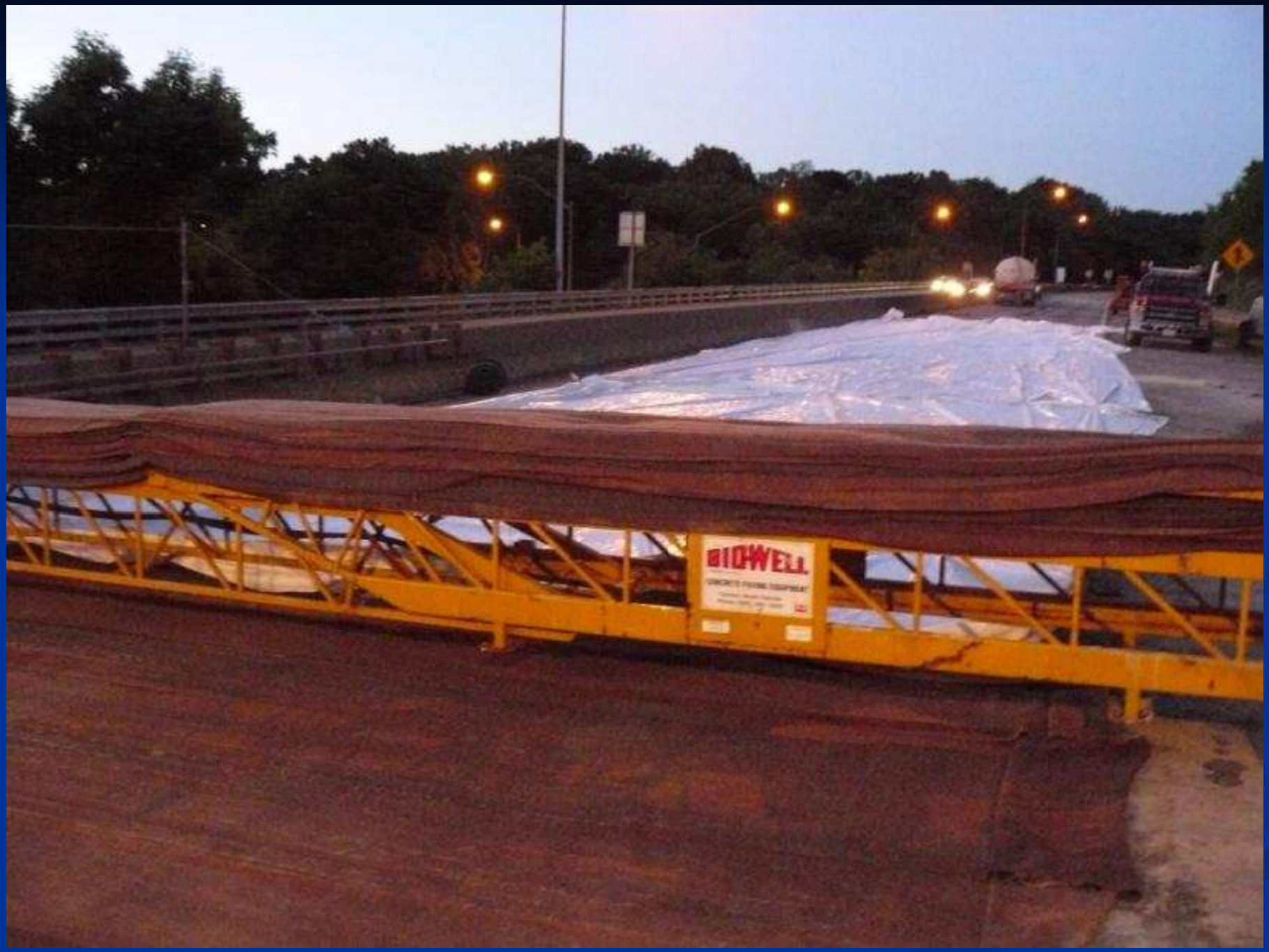

3
BIOWELL

Latex Modified Concrete Cure

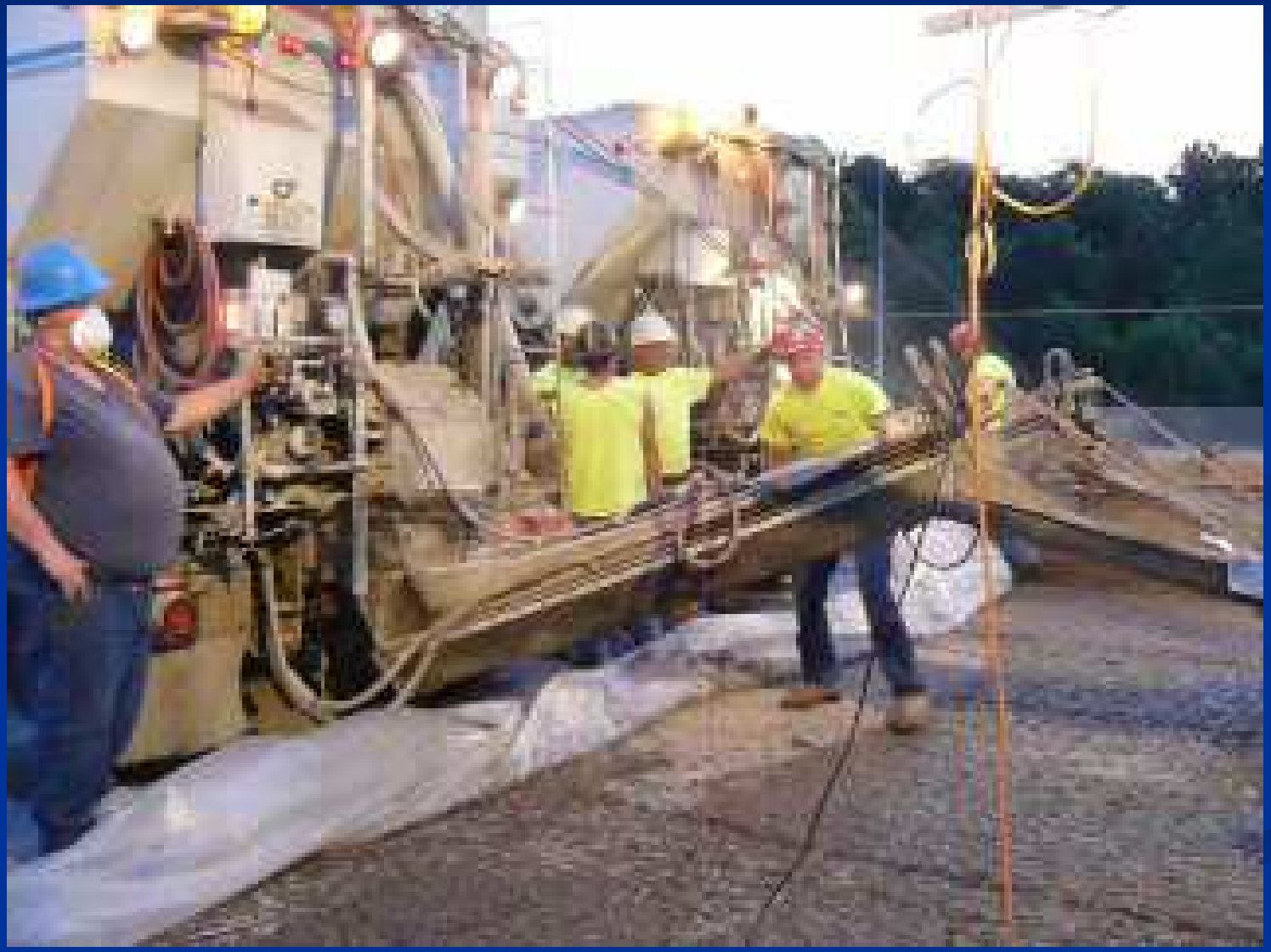
- Cure durations vary based on cement type.
- Cover freshly placed and finished overlay with one layer of wet burlap and one layer of white polyethylene film of 4 mils minimum thickness – within ½ hour of placement.
- Continuously soak the burlap for the entire wet cure period.
- Temperature should not fall below 45 degrees during the cure period.

Latex Modified Concrete Cure Durations

- Type I Mix - 4 day cure – 2 wet / 2 dry
- Type III Mix - 48 hrs = 1 wet / 1 dry
- Rapid Set Mix - 3 hrs wet = 2500 psi


BIDWELL

RSLMC Installation Video



RSLMC Installation Video

DOT – Hydrodemolition / LMC Specifications

- Item 202 – Bridge Deck Overlay, Remove (sy)
- Item 202 – Bridge Deck Scarification (sy)
- Item 202 – Bridge Deck Hydrodemolition (sy)
- Item 722 – Bridge Deck Patching, Full Depth (sf)
- Item 722 – Bridge Deck Patching, Partial Depth (sf)
- Item 722 – Bridge Deck Overlay (sy)
- Item 722 – Bridge Deck Overlay, Additional (cy)

Rapid Set Latex Modified Concrete

- Adding very early strength hydraulic - portland cement to the LMC mix. The cement is designed to cure very quickly.
- Achieves compressive strengths of over 2,500 psi in 3 hours – traffic ready.
- Provides the same benefits as LMC overlays.
- RSLMC has been used on projects throughout the US since 1991.
- RSLMC is very impervious to chemicals that deteriorate standard concrete.
- RSLMC results in better bonding and less cracking.
- Typically used on weekend and overnight projects. Can be used and weekday projects.

- A Rapid Set LMC overlay placed on a hydrodemolition prepared surface = The fastest construction method to repair a bridge deck. Because project durations are minimized, money is saved on maintenance of traffic costs and road user costs. Future maintenance costs are also minimized and by adding additional years of service life to a bridge deck, funds become available to repair more bridges.

- For additional information visit - www.RSLMC.com

TYPICAL WEEKEND SCHEDULE:

Friday

9:00 pm to 10:00 pm - Close roadway.
10:00 pm to 12:00 am - Remove Ex. O/L
12:00 am - Hydrodemolition

Saturday

12:00 am to 12:00 pm - Hydrodemolition
12:00 pm to 12:00 am - RSLMC O/L

Sunday

12:00 am to 4:00 am - Cure RSLMC O/L
4:00 am to 12:00 pm - Cleanup work area.
12:00 pm to 2:00 pm - Open roadway

Record Setting RSLMC Overlay Project in Pittsburgh, Pennsylvania Summer 2007

- Allegheny Parkway - ADT = 123,000 VPD
- 21 bridge decks repaired using RSLMC in just 14 weekends.
- RSLMC Record - 31,467 sy of bridge deck overlay performed on a single project.
- RSLMC Record – 1,750 cy of overlay material placed on a single project.
- Existing LMC Overlays being replaced were 23 years old.
- Work began on March 23, 2007 and was completed on July 22, 2007.
- Additional projects in 2008, 2009 & 2010.

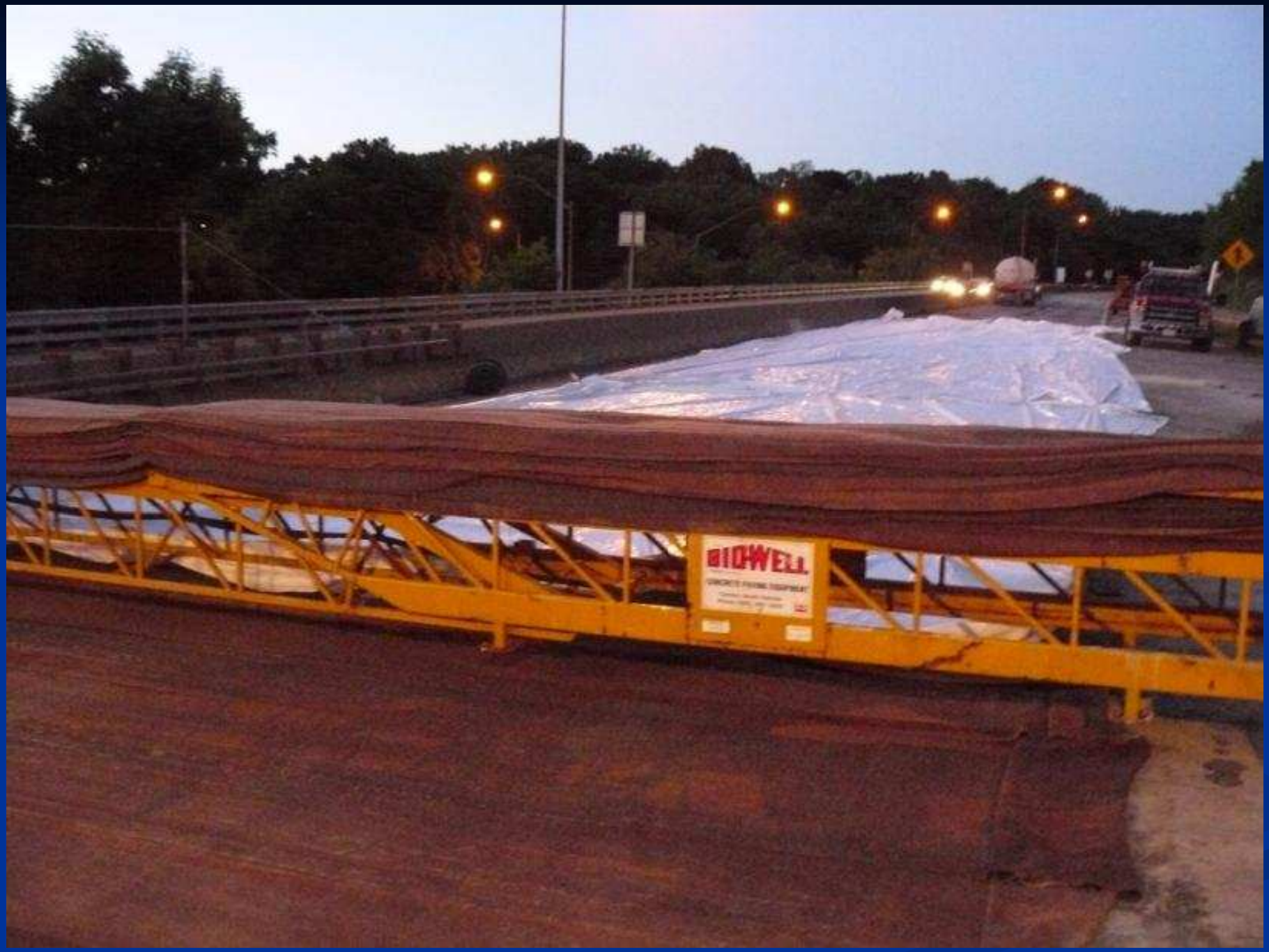

SWANK
W 2100


SWANK
W 120 F


Sabre


MODIFIED
CONCRETE
T-05
KENWORTH


BIDWELL
3600


BIDWELL

TYPICAL OVERNIGHT SCHEDULE:

7:00 pm	– Lane Closures
7:15 pm to 8:15 pm	- Mechanical Milling
7:30 pm to 8:30 pm	- Light Handchipping
8:30 pm to 9:30 pm	- Hydrodemolition
9:00 pm to 10:00 pm	- Cleanup
10:00 pm to 12:00 am	- Finish Machine Setup + dry runs
12:00 am to 2:00 am	- Pour RSLMC
2:00 am to 5:00 am	- Cure RSLMC
5:00 am to 6:00 am	- Cleanup + Temporary Stripes
By 7:00 am	- Open to Traffic

Record Setting RSLMC Overlay Project in Monroe, Louisiana Fall 2008 to Spring 2009

- I-20 Elevated Section (West Approach) – Oacchita Parish
- 37,319 sy of bridge deck area being repaired using RSLMC – nighttime closures only on I-20 over Ouachita River – World War II Memorial Bridge.
- Existing LMC Overlays being replaced were 23 years old.
- Work began on October 1, 2008 and is complete. 60 nights to complete.


WEST
INTERSTATE
20
RAMP
CLOSED


STATE POLICE
West Monroe


MAMCO
2115